WHAT WE CLAIM AS OUR INVENTION IS:

1. A system for regulating the flow of working fluid to a high-pressure pump that supplies pressurized working fluid for a fuel injection system of an internal combustion engine, the system comprising:

a body, an inlet throttle valve in the body, an inlet passage in fluid communication with the inlet throttle valve to flow low-pressure working fluid to the valve, an outlet passage in fluid communication with the inlet throttle valve to flow working fluid from the inlet throttle valve to the pump, a control passage to communicate pilot fluid to the inlet throttle valve for controlling fluid flow through the valve, a spring biasing the inlet throttle valve to an operating position, and control means for automatically controlling the flow of pilot fluid through the control passage in response to a signal representing the desired position of the valve;

the inlet throttle valve comprising a bore in the body extending along an axis, the bore having axially opposed first and second ends, a wall extending between the ends, a spool in the bore, the spool axially movable along the bore to regulate the flow of fluid through the valve, and a chamber in the bore between the spool and the first end of the bore;

the spool comprising axially opposed closed ends and a cylindrical wall extending between the ends, and inlet and outlet openings extending through the spool wall for flowing working fluid into and out of the spool;

the inlet passage comprising a first opening in the bore wall in registration with the spool inlet opening to flow working fluid from the inlet passage into the spool;

the outlet passage comprising a second opening in the bore wall in registration with the spool outlet opening to flow working fluid from the spool into the outlet passage;

the control passage opening into the chamber, the control passage configured to flow pilot fluid into and out of the chamber; and

the spring biasing the spool towards the first end of the bore;

wherein the position of the spool in the bore and thereby the flow of working fluid through the inlet throttle valve are determined by a pressure balance between the spring and the pilot fluid in the chamber independently of the pressure of the working fluid.

2. The system as in claim 1 wherein the chamber is a first chamber and the inlet throttle valve comprises:

a second chamber adjacent the second end of the bore; and

the inlet passage opening and the outlet passage opening are between the first and second chambers.

3. The system as in claim 2 wherein the spring is captured in the second chamber.

4. The system as in claim 2 wherein the inlet throttle valve comprises a vent passage fluidly connected from the second chamber to a substantially constant pressure source to maintain a

substantially constant internal pressure within the second chamber.

5. The system as in claim 2 wherein the inlet passage is fluidly connected to a sump that is the source of the working fluid, and the vent passage is fluidly connected to the second chamber and the sump.

6. The system as in claim 2 comprising at least one bleed line flowing from the interior of the spool to an opening on the outside surface of the spool, the bleed line opening located between the second chamber and the discharge passage opening.

7. The system as in claim 6 comprising an annular groove formed on the outside of the spool, each bleed line opening in the groove.

8. The system as in claim 1 wherein the inlet passage opening and the outlet passage opening are axially spaced from each other along the bore wall.

9. The system as in claim 8 wherein one or both of the inlet passage opening and the outlet passage opening surrounds the bore.

10. The system as in claim 1 wherein the spool inlet and spool outlet openings are axially spaced from each other.

11. The system as in claim 10 wherein at least one of the spool inlet and outlet openings comprises a plurality of openings.

12. The system as in claim 11 wherein the plurality of openings are spaced around the spool and include a first set of large openings adjacent one end of the spool and a second set of small openings axially spaced from the large openings.

13. The system as in claim 11 wherein the plurality of

openings comprises pairs of diametrically opposed openings.

14. The system as in claim 11 wherein the plurality of openings comprises a first set of openings and a second set of openings axially spaced from the first set of openings.

15. The system as in claim 1 wherein the spool outlet is movable into and out of registration with the outlet passage opening or the spool inlet is movable into and out of registration with the inlet passage opening to increase or decrease the flow of working fluid through the valve.

16. The system as in claim 15 wherein the spool outlet is movable into and out of registration with the outlet passage opening and the spool inlet remains in registration with the inlet passage opening throughout the range of movement of the spool.

17. The system as in claim 1 comprising a stop located between the spool and the control passage to limit axial movement of the spool toward the control passage and thereby prevent closing the control passage by the spool.

18. The system as in claim 1 wherein the inlet passage comprises an additional bore in the body, the additional bore having a length substantially parallel with the inlet throttle valve bore.

19. The system as in claim 1 wherein the working fluid comprises engine fuel or lubricating oil and the pilot fluid comprises engine fuel or lubricating oil.

20. The system as in claim 1 comprising a low-pressure pump fluidly connected to the inlet passage upstream of the inlet

throttle valve.

21. The system as in claim 1 wherein the spool is axially movable between a first operating position and a second operating position and the inlet throttle valve comprises a pilot drain port to drain pilot fluid out of the compartment, the pilot drain port comprising a third opening in the bore wall, movement of the spool opening and closing the third opening wherein the spool closes the third opening when the spool is in the first position and the third opening is open when the spool is in the second position to establish the second position of the spool.

22. The system as in claim 1 wherein the outlet passage is fluidly connected to a plurality of hydraulically actuated fuel injectors or to a common rail.

23. A pilot-controlled inlet throttle valve assembly for controlling the flow of working fluid to a high-pressure pump pressurizing the working fluid of a fuel injection system of a motor vehicle engine, the assembly comprising:

a body, an inlet throttle valve in the body, an inlet passage to flow working fluid to the inlet throttle valve, an outlet passage to discharge working fluid from the inlet throttle valve to the pump, and a fluid circuit to communicate a pilot fluid to the inlet throttle valve and selectively operate the valve in response to the pilot fluid pressure;

the inlet throttle valve comprising a bore in the body, the bore having axially spaced first and second ends, a wall extending between the ends, a hollow piston in the bore, the piston slideable

in the bore to control the flow of fluid through the valve, a chamber in the bore between the piston and the first end of the bore, and a spring biasing the piston towards the chamber;

the fluid circuit opening into the chamber, the fluid circuit configured to flow pilot fluid into and out of the chamber for controlling the position of the piston along the bore;

the inlet passage comprising a first opening in the bore wall and the outlet passage comprising a second opening in the bore wall;

the piston comprising axially opposed closed ends, an outer surface surrounding the interior of the piston, and a flow passage extending through the interior of the piston between the ends of the piston, the flow passage in fluid communication with the first and second openings to flow working fluid through the inlet throttle valve, and a valving edge opening and closing the flow passage with movement of the piston;

wherein the position of the piston along the bore is established by a pressure balance between the spring and the pilot pressure in the chamber and is substantially unaffected by pressure fluctuations in the working fluid flowing through the valve.

24. The inlet throttle valve assembly of claim 23 wherein the flow passage comprises first and second piston openings, each piston opening extending from the outer surface of the piston to the interior of the piston, the first piston opening facing the first wall opening and the second piston opening facing the second wall opening to flow working fluid through the valve assembly.

25. The inlet throttle valve assembly of claim 24 wherein the valving edge surrounds one or both of the first and second piston openings.

26. The inlet throttle valve assembly of claim 24 wherein the first and second wall openings are axially spaced from each other.

27. The inlet throttle valve assembly of claim 26 wherein the first and second piston openings are axially spaced from each other;

the first piston opening comprises a plurality of openings spaced around the piston; and

the second piston opening comprises a plurality of openings spaced around the piston.

28. The inlet throttle valve assembly of claim 27 wherein at least one of the said plurality of openings comprises a plurality of larger diameter openings and a plurality of smaller diameter openings.

29. The inlet throttle valve assembly of claim 28 wherein the larger diameter openings are axially spaced from the smaller diameter openings.

30. The inlet throttle valve assembly of claim 23 wherein the inlet passage is fluidly connected to a low-pressure pump upstream of the inlet throttle valve.

31. The inlet throttle valve assembly as in claim 30 wherein the low-pressure pump has an operating speed and the discharge pressure of the low-pressure pump fluctuates with changes in operating speed.

32. The inlet throttle valve assembly of claim 23 wherein the position of the piston along the bore is controlled by an engine control module.

33. The inlet throttle valve assembly of claim 23 wherein the inlet throttle valve comprises a hydraulic stop that opens to flow pilot fluid out of the chamber when the piston reaches a predetermined position along the bore.

34. The inlet throttle valve assembly of claim 23 wherein the chamber is a first chamber at one end of the piston and the inlet throttle valve comprises a second chamber at the other end of the piston, the second chamber containing the spring.

35. The inlet throttle valve assembly of claim 34 wherein the second chamber is fluidly connected to an essentially constant pressure source wherein the internal pressure of the second chamber is independent of the axial position of the piston.

36. The inlet throttle valve assembly of claim 23 wherein the outlet passage of the inlet throttle valve is fluidly connected to at least one of a hydraulically-actuated fuel injector and a common rail.

37. A method of regulating the flow of working fluid to a high-pressure pump in a fuel injection system of an internal combustion engine, the method comprising the steps of:

(a) providing an inlet throttle valve and a fluid passage from the inlet throttle valve to the pump, the inlet throttle valve comprising a flow passage to flow fluid through the inlet throttle valve to the fluid passage and a hollow piston comprising an outer

surface obstructing the flow passage, the flow passage extending through the outer surface to flow fluid through the piston;

(b) flowing working fluid through the flow passage and the interior of the piston to flow fluid through the inlet throttle valve and to the high-pressure pump;

(c) generating a signal representing the desired instantaneous rate of flow of working fluid discharged from the pump; and

(d) moving the piston to open or close the flow passage in response to the signal to control the output of working fluid discharged from the inlet throttle valve and flowed to the pump.

38. The method of claim 37 wherein the flow passage comprises separate inlet and openings in the piston wall.

39. The method of claim 37 wherein the piston is movable along a longitudinal axis and the inlet and outlet openings extend radially through the thickness of the piston wall.

40. The method of claim 37 wherein the inlet and outlet openings are axially offset from one another.

41. The method of claim 37 wherein the piston is movable in a bore, the piston dividing the bore into first and second chambers, each chamber on an opposite end of the piston, and step (d) comprises the step of:

(e) flowing pilot fluid into the first chamber to move the valve member in a first direction axially along the bore.

42. The method of claim 41 wherein step (d) comprises the step of:

(f) continuously urging the piston to move in a second direction opposite the first direction; and

(g) draining pilot fluid from the first chamber to move the piston in the second direction.

43. The method of claim 41 wherein the piston is movable in the first direction to an operating position and step (d) comprises the step of:

(f) draining pilot fluid from the first compartment in response to the piston reaching the operating position and therein limiting axial movement of the valve member in the first direction.

44. The method of claim 41 including the step of:

(f) maintaining a substantially uniform pressure in the second chamber during operation of the inlet throttle valve.

45. The method of claim 37 wherein step (b) comprises the step of:

(e) fluctuating the pressure of the working fluid flowing through the inlet throttle valve.